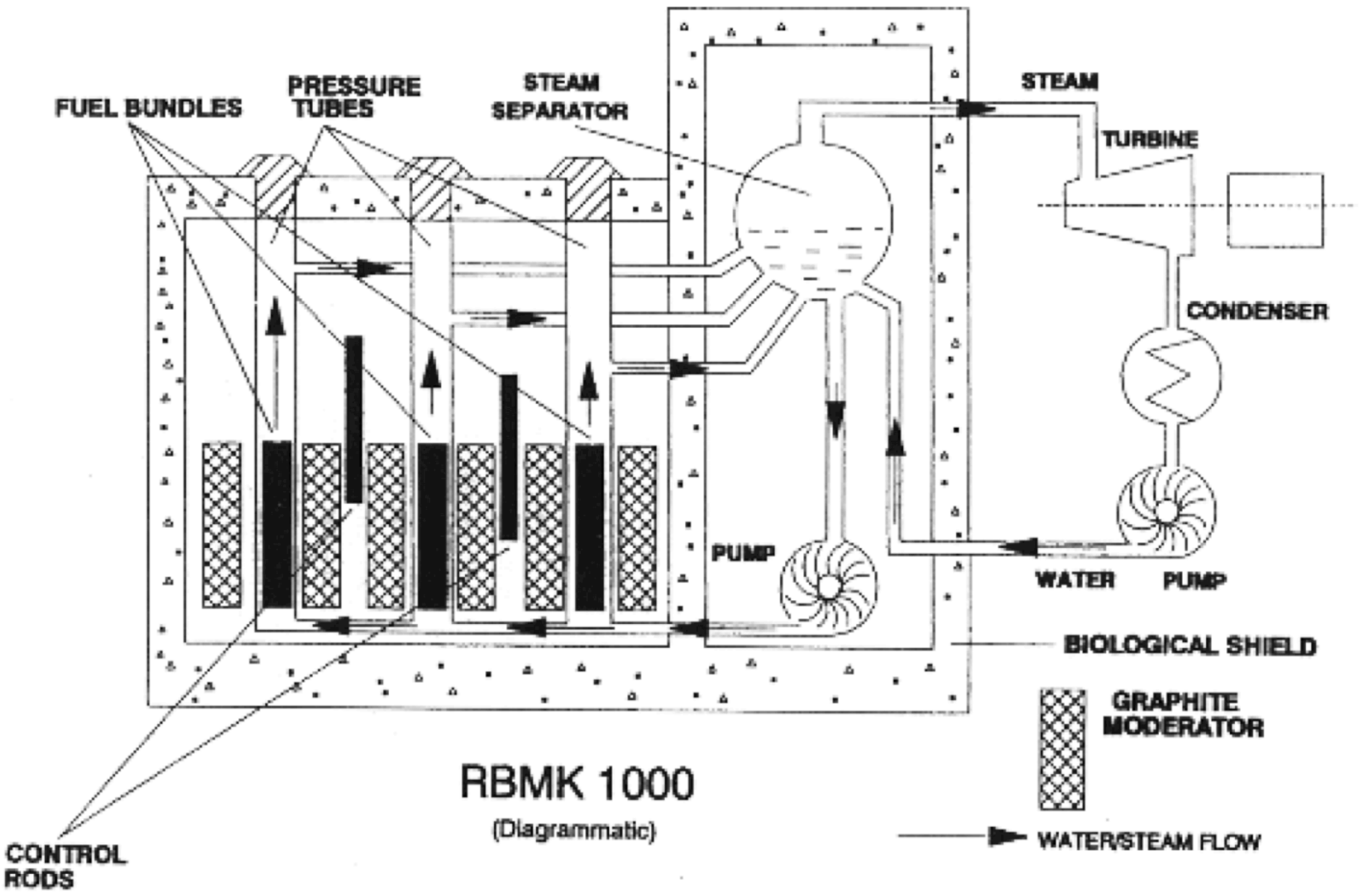
Chernobyl Disaster

Environmental Toxins Class
University of Colorado Boulder June 2013

April 26, 1986,
Chernobyl, Ukraine



RBMK 1000

(Diagrammatic)

The events of that day…

What happened

- Chemical explosion at the reactor core followed by reactor meltdown which lead to 192 tonnes of reactor fuel and 300-800 tonnes of graphite released into atmosphere or ejected into surrounding areas.
- Debris and fuel from explosions started multiple fires and a plume of about 1km was seen.
- Two immediate casualties.

Emergency Response

- Water to stop fires ended up flooding units 1 and 2 and is stopped after half a day.
- Helicopters dropped 5000 tonnes boron, dolomite, sand, clay and lead to extinguish the fires and to prevent the further release of radioactive particles.

The events of that day…

How it happened

- Low power generations test (emergency systems were disabled).
- Reduced the power level too quickly which poisoned the reaction and removed control rods to compensate
- Could not raise power output about 30 MW, but decided to remove more control rods and were able to stabilize at 200 MW
- Shut off turbine and reduced electrical supply to water pumps.
- Design flaw of the reactor lead to overheating when coolant was reduced.
- With only 6/211 control rods to accept neutrons the reaction accelerated. When graphite tipped rods are reinserted the reactivity is increased until the reactor core exploded. (Grigori Medvedev- 10 Hiroshimas)
- Three seconds later is followed by second explosion with disputable causes.

Human Exposure & Health Effects

- Why was there no immediate evacuation/preventative treatment?
  - Inaccurate dosimeter, withheld information about fire's location
  - Reactor crew and firefighters died of acute radiation sickness
    - 237 people affected by acute radiation sickness, 31 died within 3 months
  - Evacuation of 135,000 people started 36hrs after the explosion, with no outside communication. Sweden detected the actual cause of the radiation first, forcing the SU to announce it 2 days later.
  - 216 Russian, 150 Belarussian, and 5,722 (??) Ukranian clean up workers died of non-cancer radiation in 4 years (Bulletin of Atomic Scientists)

Potassium Iodide and the Difficulties in Predicting Cancer

- Iodide tablets and thyroid cancer
- No increase in birth defects or 'solid' cancers, but 6000 excess thyroid cancers as of 2005 (UNSCEAR 2005), estimated to reach more than 50,000 excess cases over exposed patient lifetimes (Int. Physicians for the Prevention of Nuclear War); WHO predicts 4000 future cancer deaths using LNT models.
- 2500 add'l abortions above average rate in fall out zones spanning 1000km in 1yr period after explosion
- Mutation data, particularly for teratogenic effects, is incredibly varied
- Nukepills. Indeed. http://www.nukepills.com/Chernobyl-potassium-iodide.html

Avoiding Repeats of Chernobyl

- Emergency plans must assign everyone's responsibilities clearly
- Measures such as the rapid distribution of iodine tablets immediate and across national frontiers.
- Well-equipped rescue teams and well-trained staff to ensure rapid measurement of radiation
- Better construction and design of Nuclear Plants.
- Free flow of information – secrecy creates a environment that will increase risk.
- Unforseen combinations of human actions.

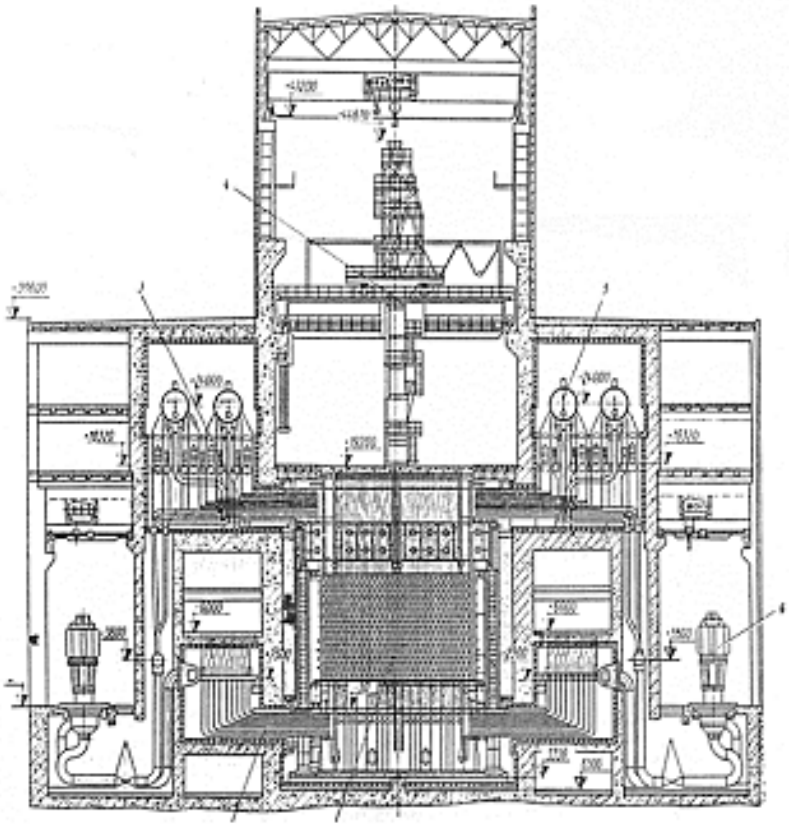


Fig. 1 Chernobyl Reactor

QUESTIONS?!

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